

# **A Study of the Future of Solid Waste Management: A Report to the Wisconsin Legislature**

**January 2001**

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## **1. Introduction**

This report explores the current solid waste management trends and issues facing Wisconsin and makes suggestions for increasing efficiency and effectiveness of waste management in Wisconsin. While the report addresses solid waste management overall, greater detail is provided about recycling and non-hazardous municipal solid wastes, and lesser detail is provided about other waste types (hazardous wastes, industrial solid wastes, household hazardous wastes, and medical and infectious waste). The report is provided as an interagency study, prepared by the Wisconsin Department of Natural Resources, Bureau of Waste Management, and UW-Extension, Solid & Hazardous Waste Education Center. The report lays a foundation for further involving stakeholders to develop a shared vision and goals to improve the way we manage Wisconsin's wastes in the future.

### **1.1. Legislative Charge**

In 1997 Wisconsin Act 60, the Wisconsin Legislature directed the Department of Natural Resources, in cooperation with the University of Wisconsin Extension's Solid and Hazardous Waste Education Center (SHWEC), to:

“conduct a study of the future of solid waste management, including an examination of ways to increase the efficiency and effectiveness of current recycling programs and an examination of ways to improve coordinated and cost-effective management of solid waste in Wisconsin.”

### **1.2. Definition of Terms**

The Legislative charge uses three terms as the basis for the analysis: “efficiency”, “effectiveness”, and “cost-effective”. There are a number of possible definitions for these terms and ways to measure them in the context of waste management and recycling. For the purposes of this study, the terms are generally used as follows:

- Efficiency refers to the monetary cost per unit, such the cost for collecting or disposing materials. Efficiency data may be presented as cost per ton of material, cost per household, or cost per person.
- Effectiveness refers to outcomes or benefits, such as the amount of material collected for recycling and reduction in pollutants or waste generation. Data on effectiveness is often presented in units of weight and may be associated with a specific period of time, such as tons/year.
- Cost-effectiveness implies a cost comparison between alternatives that achieve the same objective, in order to evaluate whether the benefits are commensurate with costs. Evaluation of cost-effectiveness may be based on either cost minimization or benefit maximization. The most cost-effective approach either: a) achieves waste reduction and recycling objectives at the lowest cost (cost minimization) or b) produces the greatest benefits for the same cost (benefit maximization).

Wisconsin's Recycling Law does not use the terms efficiency, cost-effective or cost-effectiveness, nor does the Law require evaluation of local programs on the basis of costs. However, the Recycling Law specifically directs local governments to develop "effective recycling programs". Hence the emphasis in the early years of program implementation was on maximizing benefits. Cost-effectiveness of programs became a topic of discussion in the mid-1990's, once programs were fully operational and review of DNR data showed a wide range of costs among recycling programs.

### **1.3. Study Process**

The Department and UW-Extension designated a joint work group that began meeting in early 1998. The work group recognized that before considering the future of solid waste management and examining ways to improve efficiency, effectiveness, and coordination, it was first necessary to characterize the current system, based on a common understanding. As a result, significant portions of this report are devoted to summarizing Wisconsin's current solid waste management system, with additional detail provided in the appendices. In accordance with the original legislative directive, the report also describes a number of important issues to consider for future action to improve Wisconsin's solid waste management system. Since the report focuses mainly on municipal solid waste, it does not provide the broader vision necessary to make substantial changes and improvements in Wisconsin's waste management system overall.

To characterize the current solid waste system and begin considerations for the future, the work group drafted the document, *Status of Waste Management in Wisconsin* (contained in Appendix 7.1.) and developed *Issue Papers on the Future of Solid Waste Management in Wisconsin*. The original Issue Papers are provided in Appendix 7.2. The eight issues, with minor rewording and renumbering from the original statements, are as follows:

1. How should the solid waste management hierarchy be applied or further implemented? What role should the state play in promoting the hierarchy?
2. How do we assure the implementation and delivery of cost effective solid waste and recycling services?
3. What are the future needs for processing and disposal capacity? How are these needs affected by changing materials in the waste stream and life cycle cost and benefit analysis?
4. How should landfill design requirements and concerns be balanced with land use considerations?
5. What are the long-term impacts of current "dry tomb" landfill design?
6. Should we limit or prevent open burning and on-site burial of solid waste?

7. What approaches should be used for better management of problem materials in the future?
8. What is the future role of state funds and staff for solid waste management and recycling?

To obtain input from external stakeholders, in July 1998 the work group convened a meeting with waste management professionals and external partners/stakeholders to discuss the issues and scope of the study (summarized in the *External Meeting Notes, July 1998*, contained in Appendix 7.3.). Roughly 60 participants represented local governments, local recycling programs, environmental groups, other nonprofit organizations, trade associations, waste disposal and recycling services, consultants, tribal nations, research and educational institutions, industrial generators and state agencies.

During the external meeting, participants were asked to rate the importance of the issues and suggest other topics the study should encompass. Their responses, as seen in the *External Feedback on Draft Issue Papers* (Appendix 7.4.), showed considerable divergence of opinion on both the relative importance of the issues and on the value of conducting the study. However, stakeholders at the July 1998 meeting expressed general agreement for the need to study the topics presented in issue papers 1, 3, 7, and 8.

Because of the divergent opinions expressed at the meeting, participants were asked to complete *Stakeholder Post-Meeting Evaluations* (Appendix 7.5) in July 1998. In the evaluations, stakeholders again expressed divergent perspectives and concerns about the process and scope of the study. Some asked what problem the study would solve, since the current waste management and recycling systems appear to be working well in Wisconsin. Others felt that until the Legislature decided whether or not to continue grant funding to local recycling programs, studying future directions for waste management would be premature. Still others were eager to move ahead with developing new initiatives and expressed frustration with the status quo or loss of momentum.

DNR Waste Management staff also rated the importance of the eight issues and added others they considered important. The results showed general agreement among staff that all the issues are important.

In August 1998, the work group also convened a Cost Effectiveness Improvement Stakeholders' Group, including managers of local government recycling programs and hauling services. Notes from the meeting are provided in the *External Meeting on Cost Effectiveness, August 1998: Key Factors Driving Cost Effective Programs* (Appendix 7.6.). The key factors identified by this stakeholders' group related to the areas of administration, operations, and competition/cooperation/attitude. Common themes included:

- The benefits of managing recycling and waste disposal services together.
- The need for continuing education and outreach, for program managers to stay informed and for the public to participate actively in recycling programs.
- The need to review the materials banned from disposal and consider differences between rural and urban waste generation.
- The need for and benefits of some further cooperation/consolidation among Responsible Units for recycling.

The Cost Effectiveness Improvement Stakeholders' Group also supported collection and analysis of cost data from twenty five curbside recycling and disposal programs. The group followed up by reviewing the results and discussing the conclusions, as described in Section 3.2 below. Summary data is provided in Appendix 7.7.

#### **1.4. Revised Approach to the Study**

Although the legislative directive did not specify external involvement, DNR and UW-Extension's initial approach to the study was to involve stakeholders. However, based on the wide divergence of feedback received during the meetings with stakeholders, it became clear that a joint effort with stakeholders would require much more time than originally planned, and consensus among stakeholders would not be reached within the scope of this study. As a result, the DNR and UW-Extension work group reexamined the charge and approach to this study. As described in the *Shared Vision and Goals to Improve Waste Management Meeting Notes* (Appendix 7.8), the work group concluded that the broad changes necessary to significantly improve waste management in Wisconsin would require development of a shared vision and goals through extensive dialogue with stakeholders beyond the scope of this study.

After consultation with involved Legislators and managers at DNR and UW-Extension, the work group agreed to proceed with an interagency approach to this study, and to concurrently work to secure needed resources and support for a statewide consensus-building process to follow. The work group then explored how to best develop the consensus building process, and agreed to attempt application of the environmental management system (EMS) model. This is a method used by businesses to determine the environmental impacts of their decisions and direct future decisions to produce better environmental results. The EMS effort is described in Section 4.

## **2. Wisconsin's Solid Waste Management System**

This section summarizes Wisconsin's current methods of solid waste management. Key developments in Wisconsin's waste laws are also included. More detailed information on these topics is provided in Appendix 7.1.

## 2.1. System Characteristics and Infrastructure

- Landfilling is the predominant disposal method, used for 60% of our municipal solid waste (MSW), followed by recycling and composting (36%), and waste-to-energy combustion (less than 4%). If we also factor in the yard wastes managed on-site by backyard composting, mulching and other source reduction methods, Wisconsin's diversion rate is 40%.
- Unlike some of our neighboring states, notably Minnesota and Iowa, Wisconsin has no requirement for coordinated planning, development and delivery of solid waste management services (including disposal, recycling, composting, and household hazardous waste collection services).
- In the late 1980's, most counties prepared Solid Waste Management Plans, but few counties have revised or updated their plans since then. (Jefferson, Portage and Sauk Counties have recently updated or are currently updating their plans.)
- Other than DNR's statewide regulatory responsibility, Wisconsin law does not assign overall responsibility for solid waste management to any level of government. Most cities provide both solid waste recycling and disposal services, but many villages and towns do not take a role in managing waste disposal.
- Local governments are required to either: (1) Coordinate and provide recycling services for the 15 materials that are banned from landfill disposal by the Recycling Law, or (2) Join a larger Responsible Unit that will manage the program. In 2000 there were 1069 Responsible Units of local governments for recycling, and 34 of these were counties.
- Wisconsin's regulated infrastructure includes:
  - 45 MSW landfills;
  - 42 industrial solid waste landfills;
  - 142 material recovery facilities (MRFs) for source-separated recyclables (1999);
  - 122 licensed yard waste composting facilities (1999);
  - 19 biopile facilities for petroleum contaminated soil treatment (1998);
  - 7 licensed composting facilities for other solid wastes (1998); and
  - 2 MSW combustors with energy recovery (1998).
- Numerous on-site composting operations exist that are exempt from licensing, although the exact number of operations and amount of waste managed is not known. At least a dozen on-site composting operations serve individual restaurants and cafeterias, managing about 1200 tons per year of solid waste (1998) altogether. It is estimated that thousands of households compost yard and food wastes on-site, managing an estimated 250,000 tons per year of yard waste. No estimates are available for the number of exempt on-site farm composting operations or the amount of waste managed at those sites.

- Similar to the national trend, Wisconsin has seen dramatic consolidation of the waste industry. During the past 3 decades, average landfill size has increased, while the number of landfills has decreased as follows: approximately 2,000 in the early 1970s; about 1300 in 1976; 117 in 1992; 93 in 1997; and 87 in 2000 (includes MSW and industrial waste landfills.). Also by the late 1980's, all of the hazardous waste landfills in Wisconsin had closed, and no new hazardous waste landfills have been sited.
- While the waste industry has consolidated, and Wisconsin's waste management is still heavily dependent on landfill disposal, the range of services available today is more diverse than it was in 1990.
- In addition to increased variety of services, the past 2 decades have brought a trend toward increased on-site waste treatment. The types of waste most commonly treated on-site include: readily biodegradable wastes (yard, food, and farm wastes); contaminated soils; and industrial hazardous wastes (especially solvent recovery for reuse, and neutralization of corrosive wastes prior to disposal).

## **2.2. Recycling and Composting**

- Annual amounts of waste recycled from residential and commercial sectors in Wisconsin nearly tripled between 1990, when the Recycling Law was passed, and 1995, when most of the recycling requirements took effect. Since 1995, recycling from the residential and commercial sectors combined has continued to increase, but at a more gradual pace, reaching 1.49 million tons in 1999. These data are presented in Figure 1 below.
- Municipal waste banned from landfill disposal and collected for recycling by local government responsible units has seen a similar gradual increase each year since 1994, reaching 693,000 tons in 1999. DNR data indicate that other recyclables (not banned from landfill disposal, but collected by local programs) also increased from 1994 to 1998, but in 1999 dropped to below 1996 levels. However, reporting the quantities of these recyclables is optional, so the quantities reported are probably understated. These data are shown in Figure 2 below.
- Paper is the largest category of material as a percentage of the waste we generate (43%) and as a percentage of all MSW recycled (58%). Recycling paper products, including cardboard, newsprint, magazines, office paper and mixed waste paper, prevents landfill disposal of 850,000 tons per year of paper. (Projections for 2000 from Franklin Associates, *Wisconsin Waste Characterization & Management Study Update*, 1998.)
- The 1993 landfill ban on yard waste makes the single largest impact on our waste stream, effectively diverting over 500,000 tons a year away from disposal into beneficial use. (Franklin Associates, 1998.)

- Composting and other biodegradation processes have the potential to recycle much greater quantities of readily biodegradable wastes, perhaps as much as 50% of all solid wastes generated in Wisconsin, or nearly 5 million tons per year (1999 estimate). However, a large portion of these wastes could be recycled for direct material recovery, such as waste paper recycled for use in paper products, and waste food recycled for use as ingredients in animal feeds.
- Direct land application of readily biodegradable wastes, and the land application of these materials after composting, can provide significant agronomic benefits, including increased organic matter and soil moisture retention, and plant disease suppression. Poor quality composts may contain undesirable characteristics, such as excess salt, that can be detrimental to plants. Biodegradable wastes can also be used as ingredients in fuels. Direct land application may also be appropriate for solid wastes that have agronomic benefits, such as certain coal ash. Many wastes have been land applied for a number of years. In recent years, there has been significant increase in proposals to land apply wastes. Information is not available on total current quantities of solid waste managed through land application.
- Important factors in encouraging home composting include municipally sponsored compost bin sales programs and other outreach and information activities by state and local government (such as UW-Extension sponsored Master Composter workshops). Home composting is also encouraged by local ordinances that specifically state that home composting is allowed and that describe appropriate composter design and operating requirements.

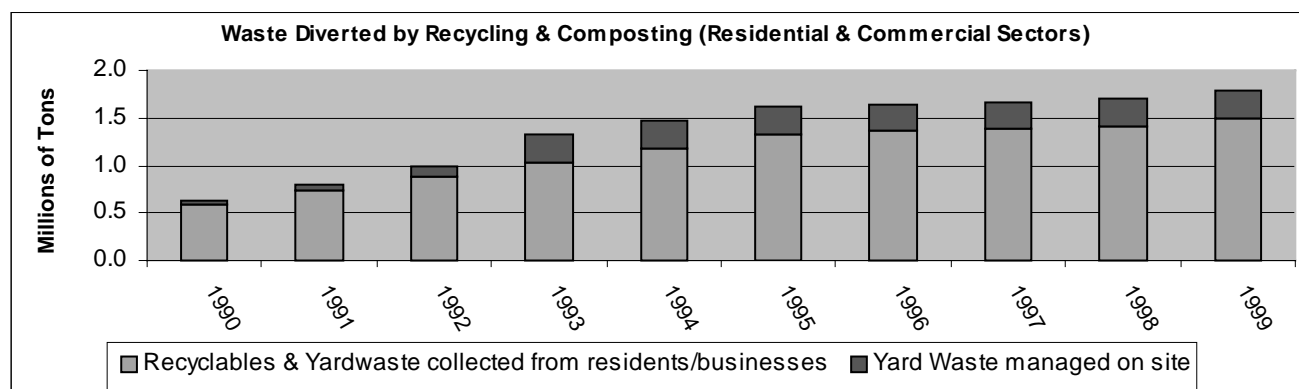


Figure 1. Waste Diverted by Recycling and Composting. Diversion for commercial sector and yard waste managed on site based on Franklin Associates reports, *Wisconsin Waste Generation and Composition Study Waste Management Study*, 1992, and *Wisconsin Waste Characterization & Management Study Update*, 1998. Commercial sector diversion for 1990 through 1999 based on estimates and projections by Franklin. Yard waste managed on site for 1993 through 1999 held constant as estimated for 1993 by Franklin. Residential sector diversion based on recyclable materials collection reported to DNR in annual reports from responsible units.

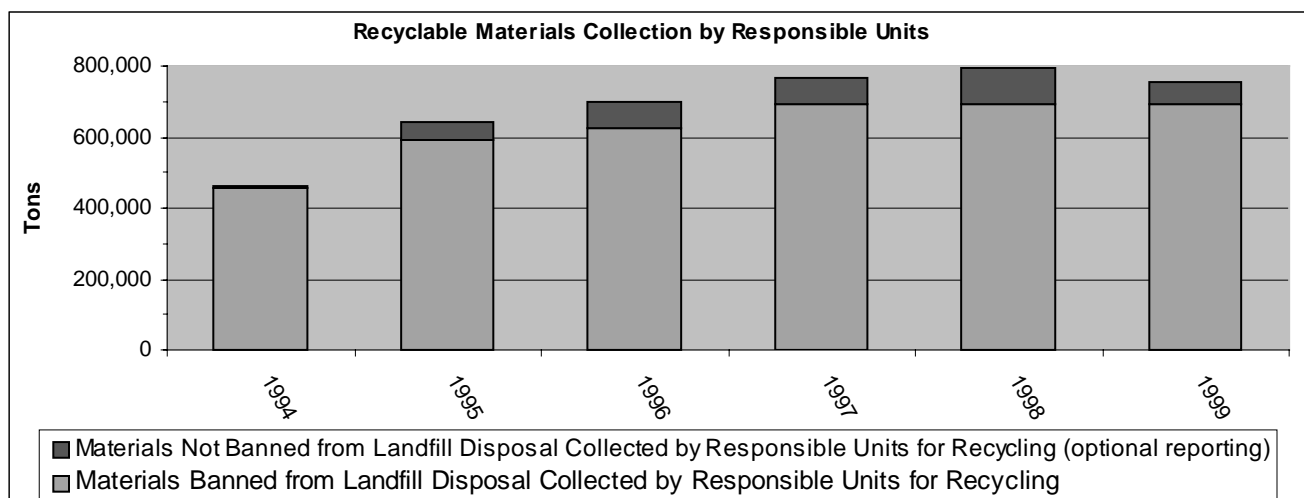


Figure 2. Recyclable Materials Collection by Responsible Units. Based on recyclable materials collection reported in annual reports by Wisconsin responsible units submitted to DNR.

### 2.3. Landfill Disposal and Waste to Energy

- While the number of licensed landfills decreased dramatically over the last 3 decades, from over 2000 to 93 facilities, total landfill tonnage for both MSW and industrial solid wastes has increased. Between 1990 and 1999, MSW landfill disposal in Wisconsin increased 38%, primarily due to increased imports from neighboring states (1.4 million tons in 1999), and increased industrial solid waste generated within Wisconsin (4.7 million tons in 1999), as shown in Figure 3 below.
- Wisconsin's solid waste disposal fees (\$38/ton on average in 1998) continue to be low compared to those in bordering states. For example, Illinois' average solid waste disposal fee was \$44/ton and Michigan's was \$63/ton (Appendix 7.1, Table 7.1-5 *Solid Waste Disposal Fees of Neighboring States*, 1998). A small percentage of solid waste generated in Wisconsin is exported to other states for disposal (estimated at 162,000 to 199,000 tons in 1998).
- Between 1990 and 1998, waste disposed by in-state generators at Wisconsin MSW landfills decreased 5%, while Wisconsin's population increased by 390,000 or 8%. MSW reduction, recycling and composting, and beneficial use of industrial waste has prevented greater increases in MSW landfill disposal by in-state generators.
- Each year in Wisconsin, about 5 million waste tires are generated, representing 50,000 tons per year of recyclable rubber and steel. Most waste tires were disposed in landfills or stockpiles until 1988, when legislative funding was provided to encourage alternatives. Wisconsin banned the landfill disposal of tires in 1995. The primary use for waste tires has been as supplemental fuel, although that market has declined rapidly since 1999. The tires to energy market peaked in 1996 with nearly 90% of waste tires in Wisconsin used as fuel.

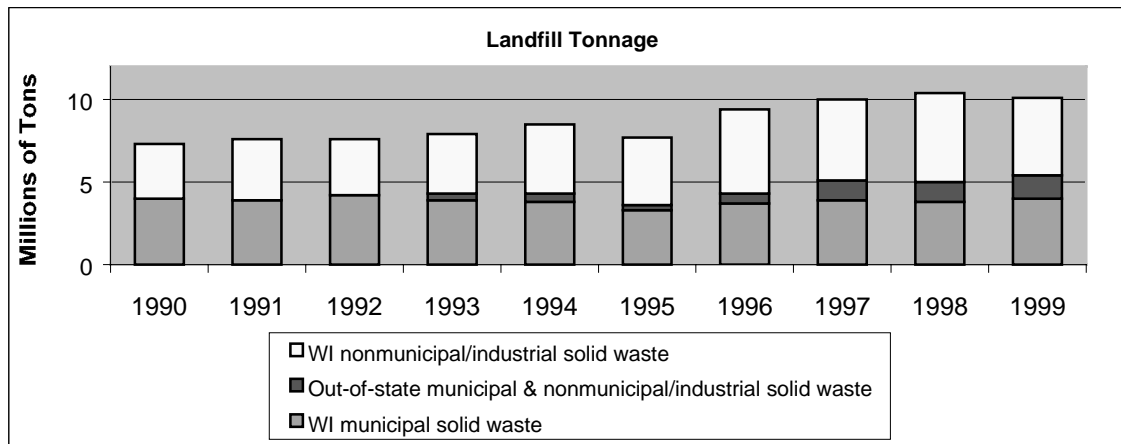


Figure 3. Tonnage Reported Annually by Wisconsin Landfills.

## 2.4. Landfill Capacity, Ownership and Design

During the 1990's, the average size of landfills increased significantly. While this has provided economies of scale, there is concern that landfill components (leachate lines, cleanouts, liners and lysimeters) may be buried so deep as to be unreachable for repair.

- During the 1990's, increasing amounts of MSW were disposed of at privately owned landfills, rather than at publicly owned landfills; by 1997 80% of Wisconsin's total tonnage was disposed at privately owned landfills.
- Of the 47 MSW landfills in Wisconsin, 20 are privately owned and 27 are owned by local governments (2000).
- Total landfill disposal capacity fluctuates from year to year, but has not demonstrated a strong trend over the past decade. As a percentage of waste disposed, MSW landfill capacity has increased somewhat, while industrial waste landfill capacity appears to have declined slightly (perhaps in part due to increased beneficial reuse of industrial wastes). For the foreseeable future there is sufficient disposal capacity for both MSW and industrial waste.
- Wisconsin's stringent landfill design requirements have proven to be protective of the environment over the approximately two decades that they have been in existence. However, the associated costs may have contributed to increasing use of burn barrels and increasing cases of illegal disposal of solid waste, particularly in rural areas where significant travel may be required to reach an operating landfill or drop-off site.
- Prior to obtaining a landfill license, owners must establish proof of financial responsibility for landfill closure and 40 years of post-closure long-term care. Payment plans are allowed for long term care. However, long-term care activities are expected to be necessary well beyond 40 years.

- Landfill owners must establish a remedial action account only if, and when, their landfill is found to have caused an environmental problem that must be remediated. In some cases, landfill owners have been unwilling and/or unable to provide remedial action moneys, and the state has instead had to finance remedial actions.
- A cornerstone of the current landfill design standards is keeping precipitation out of the waste. In recent years this practice has been criticized by some for merely delaying problems and extending the period of required long-term care. Discussions between landfill owners, academia, and the department have led to the development of pilot projects to increase waste degradation rates within landfills, primarily by adding liquids to increase the moisture content of the waste in a controlled manner. The concept, sometimes referred to as the bioreactor landfill, is being evaluated. It is not yet known how it can best be applied, or whether organic waste should be eliminated from landfill disposal instead.

## **2.5. Trends in Industrial Wastes and Special Materials**

- There has been a gradual increase in industrial waste use over the past decade. DNR estimates that in 1998, at least 1,004,116 cubic yards (or 1.2 million tons at 2,200 lb/cy) of coal ash and foundry waste was used, representing 44% of coal ash and foundry sand generated in Wisconsin. The wastes were used as a substitute for virgin materials in construction applications. Coal ash reuse in Wisconsin has been relatively common for some time, with 1987 rates estimated at 40%, but historically, the use of other industrial wastes was uncommon. Increased use has been made possible through research by industry (waste generators and construction materials industry) and the public sector (transportation, environmental, and health agencies) to determine successful material substitutions that present low risk to human health and the environment.
- Common products, such as fluorescent light bulbs and car batteries, containing components classified as hazardous waste are being effectively recycled with fewer regulatory barriers.
- Many wastes that have the potential to threaten human health and the environment are not regulated under hazardous waste laws and are managed in municipal solid waste landfills. Examples include industrial wastes and dredge sediments that include low level PCB, dioxin, and radioactive materials, as well as a variety of consumer products that contain, such as electronics that contain toxic metals.
- It is technically possible to recycle products such as electronics, mercury containing products, carpets, and paints, but it is very difficult for local governments to pay the high capital costs required to develop such programs. Substantial financial risks are associated with developing recycling facilities for these products, in part because the materials, components, and manufacture are likely to change rapidly. Collaboration with manufacturers and retailers to recycle these products and reuse their components is necessary to create the most cost-effective programs.

- Historically, discarded electronic products have not represented a large volume of the waste stream, but they are currently one of the fastest growing segments of the waste stream. For example, it is estimated that 21 million computer systems became obsolete in the U.S. in 1998, and only about 11% are believed to have been recycled, with the remaining portion disposed in landfills or incinerators. By 2007, it is estimated that 500 million personal computers will have become obsolete in the U.S. (DNR, *Managing Used Computers*, 2000.)
- Electronic products contain hazardous substances, such as heavy metals. Each computer monitor has a cathode ray tube that contains 5 to 8 pounds of lead. After vehicle batteries, cathode ray tubes are considered the single largest source of lead in municipal waste.
- Though still uncommon, some U.S. manufacturers and retailers believe that ensuring reuse and recycling of their products is a value added service desired by their customers, and that reuse and recycling can be accomplished most efficiently through a coordinated industry lead approach. Examples include: Sony's electronic product take back in Minnesota during October 2000; IBM's computer recycling facility in New York; Thermostat Recycling's services provided in conjunction with their member wholesalers, such as GE, White-Rodgers, and Honeywell; and Milliken's commercial carpet tile reclamation program.
- Carpet disposal does not pose a particular toxic hazard, but the quantity of used carpet generated, especially by commercial buildings, represents an enormous material resource. An estimated 44,000 tons of used carpet was generated in Wisconsin. (Franklin Associates, Wisconsin Waste Characterization & Management Study Update, 1998).
- Wisconsin's infrastructure for household hazardous waste services and for medical and infectious waste services is underdeveloped. These services are generally available in the more densely populated areas of the state, but are typically not available in other areas of the state.

### **3. Assessment and Options for Improvement**

This section summarizes the DNR and UW-Extension work group's assessment of Wisconsin's solid waste management system. It concludes with a review of options to improve the effectiveness and costs of solid waste management in Wisconsin.

#### **2.1.3.1. Assessment of Wisconsin's Solid Waste Management System**

Wisconsin's solid waste management system can be generally characterized as an ad hoc system which encourages a variety of waste management approaches that are determined by local governments, waste generating businesses, and waste service providers, based primarily on the landfill disposal bans and prevailing market forces. Wisconsin's solid waste management system is relatively low cost and efficient.

However, many desirable services are not offered, especially in rural areas, and considerable amounts of waste containing potentially valuable resources continue to be disposed.

The state has officially endorsed US EPA's integrated waste management hierarchy of reduce, reuse, recycle and compost, recover for energy, and lastly dispose in landfills. However, the only mechanisms to implement the concept for municipal solid waste are Wisconsin's Recycling Law (the "landfill bans" for specific materials and effective program approvals for local recycling programs) and local recycling ordinances. No comprehensive strategy to implement the hierarchy has been developed on a national or state level.

Despite the highly localized characteristics of Wisconsin's waste management system, the following observations can be made:

- Wisconsin relies on landfill disposal as the primary means of solid waste management. For most customers in the state, costs declined or remained level in the 1990's, due to the economy of scale of larger landfills, significant expansion of landfill capacity, and the increased competition which resulted. The rapid diversion of recyclables from landfill disposal in Wisconsin during the mid-90's may have also played a role in stabilizing tipping fees, due to increased competition for wastes.
- Eighty percent of waste landfilled is currently managed by the private sector, a sharp increase from 66% in the early 1990's.
- Since no single entity is charged with responsibility for solid waste management, economies of scale are often lacking in key areas of the system. The private sector component has experienced rapid consolidation in ownership of landfills and hauling services. Numerous small programs that lack economic clout in the marketplace characterize the public sector component. This has led to gaps in service, such as the lack of services for household hazardous waste and medical waste in many areas of the state.
- Very little is known about significant components of the solid waste management system because of a lack of assigned responsibility and reporting. For example, data sources for commercial waste generation and recycling rates does not exist, since annual landfill reports aggregate much of this material with residential wastes. This limits our ability to assess the need for new landfills and landfill expansions, as well as the effectiveness of commercial recycling.
- Although burning without energy recovery ranks lowest on the waste management hierarchy, burning of household waste on-site is increasing in Wisconsin. The numbers of State Fire Control permit requests indicate that as many as 500,000 burn barrels are used for waste disposal in our state. Leaf and brush burning by individual households is still a common practice in many parts of the state.

**Note:** State law generally prohibits the use of burn barrels or open burning of most household waste. Small amounts of dry combustible materials (specifically lawn and garden debris, clean dry paper, and untreated unpainted wood) from a single family or household can be burned on the property where it is generated, unless local ordinances prohibit the practice. It is likely that some prohibited materials (such as plastics, rubber, and wet garbage) are also burned at residences.

- Growing scientific evidence indicates that the common practice of burning household waste in burn barrels, even when limited to the types of materials allowed by law in Wisconsin, releases high amounts of persistent bioaccumulative toxics (PBTs), including mercury, with associated human health risks and general environmental contamination. Recent studies have found that, collectively, burn barrels for household waste are a major contributor of dioxin emissions in the Great Lakes Basin. (USEPA and NY State Department of Health, *Emissions of Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans from the Open Burning of Household Waste in Barrels*, 2000.)
- A large portion of Wisconsin has very limited or infrequent access to household hazardous waste management services. Considerable amounts of these materials (pesticides, solvents and lead-based paints) are probably disposed in landfills. Although the business/commercial sector may not landfill these products, Wisconsin law allows households/individual consumers to legally dispose of most of them.
- Today's waste stream includes a wide variety of problem materials that require new waste management solutions. For example, it is estimated that 75% of all computers ever purchased in the U.S. are currently being stored in warehouses, attics and office closets. (DNR, *Managing Used Computers*, 2000) In addition, most televisions currently in use in Wisconsin will be replaced by HDTV technology in the next 5 years. A new infrastructure is needed to manage the hazardous substances, especially the lead in cathode ray tubes, and to recycle the components.
- Other problem materials that require an integrated management solution include tires, new types of packaging, paints, new electronics and products that contain mercury.
- Significant energy is lost in the waste we landfill. Only two solid waste incinerators are currently licensed in Wisconsin. No new waste to energy facilities have been proposed in recent years.

Despite Wisconsin's historic reputation as an environmental leader, it currently lags behind a number of states in several areas of solid waste management. Some examples include:

- Minnesota has a county based system of solid waste management, including household hazardous waste disposal, and has a higher recycling rate, in terms of both material and energy recovery.

- Massachusetts recovers significant portions of the food waste stream and has mandatory toxic and pollution prevention planning for businesses.
- California manages solid waste statewide through an integrated waste management board and links its solid waste policy to reductions in air emissions, including providing funding for the conversion of diesel powered waste collection vehicles to alternative clean fuels.

### **2.2.3.2. Assessment of Local Recycling Programs**

Wisconsin's Recycling Law allows local recycling programs to be designed according to the needs of each community. As a result, Wisconsin communities have a great variety of recycling programs that include different recycling services, different levels of government taking responsibility for the recycling programs, and different degrees of integration between recycling programs and disposal services. As a result, a uniform analysis of Wisconsin's recycling programs is virtually impossible. This section describes factors that have influenced local recycling program development, provides information about recycling program costs and efforts to improve programs, and presents some national data for comparison.

#### **2.1.1.3.2.1. Factors that Influence Variations in Recycling Programs**

Cities, villages and townships were given the responsibility for implementing recycling programs when the Recycling Law was developed. However, counties may take specific action to create a Responsible Unit for member municipalities. As a result, in 1990 Wisconsin had 1848 Responsible Units with no county units; by 2000, we had 1069, 34 of which were county units.

The Recycling Law provides grants to Responsible Units based on their eligible recycling expenses. The law allowed Responsible Units to set up recycling programs that best fit their local needs and to apply for grants based on the cost of the programs they established. DNR placed some limits on the design of local programs when it implemented ch. NR 544, Wis. Adm. Code, in 1993, including a requirement for Responsible Units with a population of 5,000 or greater to establish curbside recycling programs.

Wisconsin's emphasis on ad hoc development of the solid waste management system led to the creation of 1069 individual recycling programs and a wide diversity of solid waste collection, processing and disposal services. Local program managers attribute the variations in costs and effectiveness of recycling and disposal services to the following factors (see Appendix 7.6, *External Meeting on Cost Effectiveness, August 1998: Key Factors Driving Cost Effective Programs*):

- geographic location,
- level of service,

- size of the service area,
- ability and effectiveness of managing authority,
- availability of service providers,
- type of service provider.

Canadian researchers McDavid and Liberte analyzed the full range of variables that may influence the cost of recycling programs in a national survey report “The Efficiency of Residential Recycling Services in Canadian Local Governments” (2000). Aiming to identify the factors or variables that best predict program efficiency (defined as net cost per ton for collecting residential recyclables), they developed a comprehensive list of variables, most of which are equally valid for Wisconsin programs:

1. Local Government Characteristics
  - Population served
  - Number of municipalities served
2. Policies and Regulations
  - Is a waste reduction strategy in place?
  - Is recycling mandatory?
  - Is there a target percentage for reducing solid waste disposal?
3. Producer Type
  - Local government crews and equipment
  - Contractor crews and equipment
  - Public producer in mixed arrangement
  - Private producer in mixed arrangement
4. Types and Levels of Service
  - Frequency of service
  - Service characteristics
  - Availability and type of composting
5. Equipment and Technologies
  - Types and characteristics of vehicles
  - Equipment
  - Average crew size per vehicle
6. Financing
  - Fixed fee or user fee system?
  - Does contractor capture any revenue from sale of recyclables?
  - Average prices received for sale of each type of material

## 7. Management and Human Resources

- Number of full-time equivalent recycling collection personnel
- Number of full-time equivalent depot (drop-off) personnel
- Average salaries
- Average age of collection employees
- Average number of paid vacation & sick days per year
- Number of work days per year

## 8. Productivity

- Tons per vehicle per year
- Tons per worker per year

McDavid and Liberte analyzed the effect of each of these variables on the efficiency of recycling programs. We review the results of their analysis in the next section.

### **2.1.2.3.2.2. Recycling Program Costs**

In 1999, the grant-eligible costs submitted by Responsible Units (RUs) for Recycling totaled \$76.4 million or \$14.40 per capita as a statewide average. Indian Tribes had the highest costs (\$37.30 average per capita). Per capita costs for city and village responsible units were somewhat above the average at \$17.40 and \$18.30 respectively. The higher average costs are to be expected, given that most cities and villages offer curbside collection of recyclables to parallel garbage collection service. About 40% of city and village program costs are attributed to yard waste collection and management.

County Responsible Units had slightly below average per capita costs (\$10.60) as did township RUs (\$9.70) and "other" RUs (\$7.80) in 1999. The lower than average costs are to be expected, given that most county programs did not encompass curbside collection costs and are in a good position to realize economies of scale with the operation of drop-off sites and/or a county processing facility for recyclables. Rural programs typically do not incur the cost for collecting yard waste.

Recycling costs per capita often compare favorably with the cost of waste disposal. A study of 25 curbside programs for Wisconsin's larger cities showed 1997 waste disposal costs of \$21 per capita on average. Annual curbside recycling costs were \$ 9 per capita on average and yard waste management cost an additional \$ 7 per capita on average for the 25 curbside programs. The range of average per capita costs for recycling are comparable to other municipal services such as police and fire departments and road maintenance. Wisconsin Taxpayers Alliance's report on "Comparing Municipal Expenditures: Per Capita Expenditures in 118 Cities and Villages as Self-Reported for 1998" shows wide ranges of costs for most categories of operating and capital expense.

Communities that manage their solid waste and recycling in an integrated fashion have documented many cost savings and improvements in efficiency. The City of Madison, for example, was able to reduce the number of garbage collection routes and vehicles after implementing curbside recycling, realizing substantial savings. Reductions in solid

waste collection routes, improvements in yard waste collection and home composting, and improved recycling processing efficiencies have resulted in communities that assess and develop solid waste management programs based upon all components of the waste stream. However, many communities currently manage recycling separately from disposal or take no responsibility for solid waste disposal, effectively shifting disposal costs to households.

The Canadian efficiency study by McDavid and Liberte, introduced in the preceding section, used causal modeling to rank key variables as predictors of program cost per ton and identify causal relationships among variables. Among the 100 variables they analyzed, five directly predicted net cost (Canadian dollars) per ton:

1. Full bins required: Requiring full bins **reduced** net costs per ton by \$81.
2. Participation: Increasing participation by 1 percent **reduced** net cost per ton by \$1.37.
3. Tons per vehicle: Increasing tons per vehicle by one ton **reduced** net cost per ton by \$.03.
4. Side loader vehicles: Increasing side-loader use by 1 percent **increased** net cost per ton by \$.34.
5. Number of materials accepted: Increasing the number of materials accepted by one **increased** net cost per ton by \$3.

Recycling programs incur relatively high costs when they sort, bale and market various grades of plastic containers. Some materials, like numbers 3-7 plastic, have proven very costly to recycle. Estimated for the cost of collecting and processing plastic containers are as high as \$200 to 400 per ton. Consequently, DNR has issued a variance allowing these materials to be landfilled unless and until costs decrease substantially.

The apparent trend in the beverage and plastic container industries is to introduce more multiple-layer plastics and various color PETE containers. Local governments and material processing facilities can expect to incur higher costs for sorting (and often discarding) the new plastics without receiving additional revenue to offset the costs. The situation with plastic containers makes local government programs wary of the potential costs and risks involved in collecting new materials such as cathode ray tubes/electronics, carpeting, paints, small batteries, and products containing mercury. Product designers, manufacturers and retailers are in the best position to organize an infrastructure that provides efficient and safe recovery and recycling of these materials. Some manufacturers, for example Sony and the carpet industry, have begun to take an active role in product stewardship.

### **2.1.3.3.2.3. Cost-Effectiveness of Recycling Programs**

DNR and UW-Extension have been working with local units of government to improve recycling efficiencies and effectiveness since the Recycling Law was implemented in 1990. Local programs have matured and most have become very effective in capturing and processing the recyclables, keeping them out of landfills and incinerators. Many communities have improved the efficiencies of their operations using the technical assistance and analytic tools provided by DNR and UW-Extension. In spite of the progress some municipalities have made, the cost effectiveness of local recycling programs remains a controversial issue in Wisconsin. People want to know if local programs are effective in recovering material from solid waste for recycling and if those programs are doing so efficiently.

Cost effectiveness is an issue because the costs for implementing local recycling programs varies greatly from community to community as does the percentage of recyclables recovered from the solid waste stream. No apparent relationship exists between the two, in part due to the manner in which recycling was implemented in Wisconsin. This is the result of local decision making that, on one hand, allows communities to tailor programs based on local needs, but on the other hand, makes it difficult to achieve economies of scale.

As a result of the flexibility built into the Recycling Law and DNR's administrative rule, some communities set up very basic programs, and some set up more comprehensive ones. Consequently, there is a wide range in the amount of grant money given to Responsible Units. In 1999, \$24 million in grants statewide covered an average of 30% of Responsible Unit's eligible recycling and yard waste costs. Grants ranged from a low of \$0.23 per capita to a high of \$51.03 per capita. The average grant was \$4.67 per capita. There were 192 grantees that received less than \$2 per person and 20 grantees that received \$10 per capita. \$24.5 million was available for grants in 2000 and another \$24.5 million will be available for grants in 2001.

The Recycling Law provided flexibility to address local needs and preferences in each Responsible Unit. Because it seems apparent that design elements are primary factors affecting the efficiency and effectiveness of recycling programs, the design elements were analyzed to understand their impacts on local programs. However, results of that analysis showed that it is difficult to generalize about the effects of program design elements, because other factors that cannot be isolated also have significant impact on the efficiency and effectiveness of recycling programs. This was apparent when members of the Special Committee on the Future of Recycling looked at factors affecting cost and effectiveness of local recycling programs.

Previous analyses by others have produced similar findings. In 1996 Dr. Wayne Carroll, UW-Eau Claire conducted a statistical analysis of factors that could affect cost and effectiveness of Wisconsin recycling programs. In his report, *Program Cost Analysis*, Dr. Carroll found the available cost data (1993 and 1995) too limiting to verify the impacts of any factor. David Lovell, Senior Analyst for the Legislative Council also investigated this

topic in his 1996 paper, *Future of Recycling Memo No. 5: Effective Recycling Programs; Factors Affecting Cost and Effectiveness*. In particular, Mr. Lovell reviewed Dr. Carroll's work, UW-Extension - Solid and Hazardous Waste Education Center's *Improving Cost Efficiencies of Recycling Programs* (1995), and recycling program summary data from Responsible Units reported to WDNR. Mr. Lovell's review indicated that, based on available data, the factors affecting efficiency and effectiveness are complex and do not closely follow particular patterns.

Since both Dr. Carroll and Mr. Lovell used 1995 and earlier data, DNR and UW-Extension reviewed more recent data to see if different results might be found. Information was reviewed from the 1996 and 1997 Responsible Unit annual reports and the *Summary of Survey on Costs of Twenty Five Municipal Programs*, by Paul Wiegner, DNR, and Jon Tulman, Eau Claire County (attached as Appendix 7.7). However, the Special Committee on the Future of Recycling found that the annual report information still had too many major program variables to determine the impact of any particular factor. Major program variables included: curbside collection compared to drop-off; urban compared to rural; and city compared to township.

The study of 25 city curbside programs offers the opportunity to eliminate some of the major variables while analyzing similar programs. It also collected information on garbage collection costs and tons disposed which is not available from data reported annually to DNR. The authors did a thorough job collecting and verifying data for each community for garbage and recycling expenses and amounts collected, the number of households, and the percent of total costs covered by DNR funding.

From this data, the authors were able to generate information on average costs per ton (\$75 per ton for garbage disposal, \$139 per ton for recyclables), average costs per capita (\$9.35 for recycling, \$7.19 for yard waste), and average pounds per household (2,010 pounds: 444 pounds recyclables, 1566 pounds garbage).

This data set still shows a wide range of costs or weights in each category and almost no relationship between the cost and weight data. Strong, clear relationships could not be established between solid waste costs per ton and recycling costs per ton, recycling rate and population or number of households served, recycling rate and cost per ton for recycling, tons recycled and cost per ton; or the percent DNR funding and the recycling rate.

Some relationship may exist between the recycling rate and cost per household (higher rate, higher costs), and some relationship may also exist between the pounds recycled per household and cost per household (more pounds collected, higher costs). However, this data set still had too many variables to draw conclusions on which factors contribute the most to cost effectiveness.

### **3.2.4. Recycling Costs Compared with Disposal**

The cost of recycling is often compared with the cost of disposal as an indicator of cost-effectiveness. Given that cost-effectiveness analysis requires comparison between costs for alternatives that achieve the same objective, and that recycling is a distinctly different objective from waste disposal, we should not put too much stock in this comparison. In fact, comparing recycling and disposal costs per ton only measures relative efficiency.

Legislative Audit Bureau, in its Evaluation of State Recycling Programs (2001), calculated the average cost of waste disposal, including collection, hauling and tipping fees paid by Wisconsin local governments in 1998 at \$85 per ton. Total costs reported to Department of Revenue were \$123.6 million for an estimated \$1.45 million tons of waste disposed. Average recycling costs in 1998 were \$95 per ton.

As Mr. Wiegner and Mr. Tulman observed in their detailed conversations with Responsible Units, program managers who had a better knowledge of their costs for recycling and waste disposal seem to have more cost-effective programs. This point is illustrated in the City of Kenosha case study that follows. Kenosha realized sizable annual cost savings from a thorough analysis program costs and opportunities. In the second case study, Sauk and Jefferson Counties provide examples of broad based strategic planning efforts at the county level being taken to improve solid waste management services and cost efficiency.

#### **2.1.4.3.2.4. City of Kenosha Case Study**

In 1996, the City of Kenosha, Wisconsin's fifth largest city, faced increased demands for solid waste service while at the same time needing to control budget costs. Recognizing this challenge, the Kenosha Public Service Director requested that the Kenosha County Community Development Agent assist in implementing a program to analyze the City's current program and develop recommendations and an action plan for improvement. After forming an ad hoc steering committee consisting of recycling and trash collectors, managers, MRF operators, budget staff, alderman, and concerned citizens, the "Bigger Bang for the Buck" program was initiated.

The program consisted of four workshops, custom designed for the community. Analyzing statewide data sources made available by the Wisconsin DNR, the introductory workshop provided background information on Wisconsin solid waste management trends, including collection, processing, and disposal options. A community profile was also developed to allow comparison of the community with statewide averages. Based upon this information, the project team collected and developed cost data from community sources. Two analysis tools were developed, including a "Community Solid Waste Assessment" used to determine where data gaps exist and a "Municipal Solid Waste" cost form for assessing costs by program area. Additional research by the City was required to plug gaps as revealed by the data analysis.

Based upon an on-site evaluation, UW-Extension staff presented some of the findings of the project team. A brainstorming session followed to further clarify specific forces impacting upon the current situation and potential solutions. A final program determined what changes to the current solid waste system were possible in order to develop an action plan. Community steering committee members were asked to commit to specific tasks in order to provide improvements in the solid waste management system.

As a result of this program, the City of Kenosha recognized the need to evaluate automated collection, identify and eliminate duplicative services, increase compliance through on-going education, and evaluate the applicability of volume-based fees. In addition, based upon a better understanding of market conditions, the City re-negotiated its recycling processing contract, achieving \$100,000 in annual savings.

### **3.2.6. Sauk and Jefferson Counties' Strategic Solid Waste Planning**

Recently, two Wisconsin counties have developed strategic planning initiatives to deal with uncertainties in the solid waste management market. With the assistance of the UW-Extension, county-based community development agents have designed and implemented a program to address this concern, even though neither of these counties are responsible units and therefore have no formal solid waste management responsibility.

In one case, Sauk County owns and operates a landfill and was losing customers to the consolidated private market place. In another case, Jefferson County had recently hired a part time solid waste director and needed to clarify his role as well as update their 1985 solid waste management plan. Jefferson County in particular has a long tradition of assessing needs and providing services to fill in gaps in the private marketplace.

Each county developed an interactive process to facilitate the strategic planning effort. Common elements of this process included:

- The involvement of key stakeholders in addition to the county's solid waste committee.
- Use of a step-by-step process, including mission review, learning opportunities for the committee, issue identification, strategy formulation, and action planning.
- The recognition that the strategic planning effort would have to be on-going.

The table below summarizes the key components of each of these counties' strategic planning efforts.

<b>Activity/Situation</b>	<b>Sauk County</b>	<b>Jefferson County</b>
Problem Assessment	<ul style="list-style-type: none"> <li>• County landfill faced declining tonnages due to increased competition.</li> <li>• Solid waste manager lacked authority to compete.</li> <li>• Solid waste committee needed better understanding of changing solid waste issues.</li> </ul>	<ul style="list-style-type: none"> <li>• County solid waste committee members changing due to retirements.</li> <li>• New solid waste manager needed goals and direction.</li> <li>• Committee desired planning effort that would be useful.</li> </ul>
Strategic Issues	<ul style="list-style-type: none"> <li>• What should County do to manage the waste within its boundaries?</li> <li>• How can it manage waste most cost effectively?</li> <li>• How can it manage and minimize environment liability associated with solid waste disposal?</li> <li>• How can it raise public awareness of solid waste issues?</li> </ul>	<ul style="list-style-type: none"> <li>• What can the County do to enhance the education and promotion component of solid waste management?</li> <li>• How can the County enhance its hazardous waste programs?</li> <li>• How can the County deal with emerging waste issues, including computer equipment?</li> </ul>
Action Plans	<ul style="list-style-type: none"> <li>• Identify needs of municipalities.</li> <li>• Develop market plan, including out of county waste.</li> <li>• Develop web site.</li> <li>• Conduct county-wide survey.</li> <li>• Improve Clean Sweep collection programs.</li> <li>• Develop new educational materials regarding the solid waste department.</li> <li>• Improve signage.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop guide for landfill monitoring.</li> <li>• Develop site and ordinance review procedures.</li> <li>• Develop guide for operating clean sweeps.</li> <li>• Develop education center and special programs.</li> <li>• Develop internet component and presence.</li> <li>• Develop ways to improve Clean Sweep effectiveness .</li> <li>• Explore feasibility of permanent hazardous waste collection program.</li> </ul>

### 3.2.7. Comparison with National Data

The Institute for Self-Reliance, a non-profit research and technical assistance organization with offices in Washington and Minneapolis, looked at some of the most effective recycling and waste reduction programs in the country. They found that no two programs were alike, yet all share certain key strategies:

- Composting of yard trimmings
- Targeting a wide range of materials for recovery
- Implementing participation incentives (such as volume-based fees and mandatory participation)
- Augmenting curbside programs with drop-off sites

The Institute looked at before and after solid waste (garbage, yard waste, recycling) costs for 14 out of 18 communities that implemented some of these strategies. Four communities did not have good cost data. They found 13 communities to be cost effective. The costs per household stayed the same or decreased for nine of these communities. The other four communities had increased costs, but these increases were on the disposal side. The community that was considered not cost effective had a very low tipping fee of \$10 per ton. For Madison, for example, they found the solid waste cost per household increased \$12 between 1988 and 1996. This was due to the dramatic increase in tipping fees. For Fitchburg, the cost per household dropped \$16 between 1992 and 1996.

It would be ideal to look at the before and after costs for other Wisconsin Responsible Units, which would provide a better indicator of cost effectiveness than analyzing variables. Unfortunately, most communities do not have the solid waste cost and weight data available to do so. The cost effectiveness of local recycling programs is a complex issue with many potential solutions, few being verifiable using actual data. Legislative changes must be developed in conjunction with local communities and to direct communities to adopt more cost effective recycling and garbage collection practices.

### **2.3.3.3. Conclusions**

In aggregate, local governments report recovering increasing amounts of recyclable material each year, but inevitably the total statewide diversion of materials specified for recycling must level off or plateau as recovery approaches the limits of those materials available from residential generators. At the same time our population and economy are growing, factors which historically create more solid waste. However, the fact that some communities and businesses have much more effective recycling programs than others suggests that both efficiency and effectiveness can be increased by refining programs.

The full benefits gained by recycling and composting waste may not be accounted for as a savings due to recycling, or may not even accrue directly to the local governments managing the recycling program. When recycling results in reduced garbage collection costs (reductions in fleet size, number of garbage routes, and labor), these savings are not typically accounted as a savings by the recycling program. Typically this occurs when different units of government organize recycling and waste disposal for an area; one unit of government may realize savings, while the other bears increased costs. In such circumstances, the responsible for recycling may not reap any direct savings from recycling and so may not have financial incentive to expand or improve the program.

Many recycling programs in Wisconsin will continue to be at a significant cost disadvantage as long as cost effectiveness is evaluated by comparing per ton recycling costs with per ton disposal costs. A more accurate evaluation of recycling program cost-effectiveness would consider the incremental savings (or cost) for recycling compared to waste collection and disposal costs before recycling was implemented. However, since many Responsible Units for Recycling do not manage waste disposal, they lack data to calculate the incremental cost of their programs.

#### **2.4.3.4. Assessment of the State Level Recycling Program**

Wisconsin's recycling program has been very effective in diverting materials from disposal to productive use. In the last ten years, 11.6 million tons of waste has been diverted from landfills and incinerators, avoiding the need to site and build five typically sized new landfills. Recycling in Wisconsin costs a state average of \$ 95 per ton, including collection, processing, marketing and public education. The cost for disposing waste in landfills or by incineration averages \$85 per ton. Expenses for individual communities vary depending on how their recycling program is designed and operated.

On the surface, it appears that recycling costs communities \$10 per ton more than landfilling. However, these figures do not account for materials that communities no longer have to collect. Examples would be the 290,000 tons of yard waste that's managed at home, recyclables that are taken to buy-back centers, and waste that is never generated because of waste reduction efforts. Because communities do not have to bear the expense of managing these items, they actually represent cost savings. Nor do these examples reflect the economic value of jobs created by recycling, the significant value of resources saved, or pollution prevented and energy saved through recycling or waste reduction. This is another way to look at cost effectiveness, although estimating a dollar value for these activities is very difficult.

#### **2.1.1.3.4.1. Resource Conservation and Pollution Prevention**

DNR and UW-Extension are working with the EPA and Research Triangle Institute to quantify environmental benefits of Wisconsin's recycling program. Preliminary results of the investigation are promising. Manufacturers who use Wisconsin recyclables instead of extracting new resources from the earth save energy and reduce pollution. Each year these manufacturers:

- Save enough energy to provide 302,000 households with all their electrical, heating and cooling needs.
- Produce 146,000 fewer tons of industrial waste to be landfilled.
- Reduce greenhouse gas emissions by almost 32,000 tons of carbon equivalent.
- Decrease pollutants that contribute to ozone by 12,500 tons.
- Decrease pollutants that cause acid rain by 25,000 tons.
- Keep 2,400 tons of dissolved solids and 32 tons of nutrients out rivers and streams.
- Decrease air emissions equivalent those produced by over 2 million cars.

These recycling efforts have saved a tremendous amount of resources and avoided much pollution. However, this is not sufficient to balance the detrimental environmental impacts caused by waste. For example, EPA estimates that increasing the national recycling rate from the current 28% to 35% would reduce greenhouse gas emissions by 9.8 million metric tons of carbon equivalent, compared to landfilling the same material. Better yet, if national waste generation rates were reduced to 1990 levels, greenhouse gas emissions would be reduced by 11.6 million metric tons of carbon equivalent. (USEPA, Global Warming Site, *Climate Change and Waste - What is the Link?*, 2000. Metric tons of carbon equivalent is the basic unit of measure for greenhouse gases.)

Another measure of environmental benefit is savings in landfill space due to waste reduction and recycling efforts. DNR estimates that Wisconsin's recycling effort "saves" the equivalent of one average-sized landfill every 1.5 years.

### 3.4.2. Employment and Sales in the Recycling Industry

The recycling industry is an integral part of Wisconsin's economy in terms of employment, income generation and tax revenue. The recycling industry **directly** employs over 30,000 individuals in Wisconsin, according to the Wisconsin Department of Commerce's Recycling Markets Development Board (RMDB in a 1999 draft report prepared under a grant from EPA, Region 5). Paper and paperboard manufacturing accounts for 70% these jobs. Another 50,000 jobs result indirectly from or are induced by the recycling industry or sector. The RMDB also identified \$1 billion in wages and \$5.7 billion in sales generated by the recycling sector. Minnesota and Iowa data is provided for comparison, although each state has used somewhat different methods to compute employment and economic impact resulting from recycling.

<b>Recycling Sector Economic Impacts</b>	<b>Iowa</b>	<b>Minnesota</b>	<b>Wisconsin</b>
Direct Employment in Recycling	8,800	8,700	30,000
Wages/Payroll	\$303 million	\$772 million	\$ 1 billion
Direct industrial output	\$1.1 billion	\$1.92 billion	
Total industrial output	\$2.38 billion	\$4.51 billion	
Sales			\$5.7 billion

### 3.4.3. Conclusions

Savings and benefits from recycling and composting accrue to our state and our environment as a whole. Based on preliminary results from a life cycle analysis, Wisconsin's recycling effort has produced net reductions in energy consumption, pollutants that contribute to ozone and acid rain, and greenhouse gas emissions. Overall, Wisconsin's waste diversion efforts over the last 10 years have avoided the need to construct 5 average size landfills. These statewide savings do not show up in recycling program accounts to offset program costs.

### **2.5.3.5. Options for Improving Efficiency and Effectiveness**

Based on the information collected and analyzed, and stakeholder involvement with this effort, a number of options have been identified that may improve the effectiveness of solid waste management and recycling in Wisconsin. Some of these options are discussed below.

#### **2.1.1.3.5.1. Encourage Strategic Solid Waste Planning by Local Governments**

- ✓ *Encourage strategic solid waste planning by local governments.*

Most solid waste planning was completed in the early 1980's in Wisconsin (by counties). These voluntary planning efforts have typically not been updated and often are not being implemented. Communities across Wisconsin are facing an increasing challenge to plan for solid waste needs on an on-going basis. With rapid consolidation in the solid waste industry and increasing competition between private and public operators, municipal solid waste managers have had difficulty in planning and providing for integrated solid waste management services. Strategic solid waste planning represents local governments' best defense against the complexities and uncertainties in the solid waste management market.

- ✓ *Provide technical assistance to local governments for strategic solid waste planning.*

Many municipalities and townships lack the staff resources necessary for strategic solid waste planning. This may also be true for some counties. In addition, local governments may need help with reviewing and interpreting data related to efficiency and effectiveness. UW-Extension has the skills to provide the necessary technical assistance.

#### **2.1.2.3.5.2. Encourage Cooperation Among Local Governments**

- ✓ *Encourage county and multi-county planning.*

Wisconsin counties could take the lead in coordinating a planning and implementation strategy for solid waste management. In addition, incentives could be provided to encourage multi-county planning efforts.

- ✓ *Tie recycling funding to coordinated program delivery.*

Funding for recycling could be dependent upon an implementation strategy for coordinated program delivery. An annual monitoring and reporting mechanism could be established which certifies coordination efforts. In addition, the State could biannually evaluate the cost savings generated through coordinated program delivery.

- ✓ *Establish regional waste reduction coalitions.*

Waste reduction initiatives know no political and geographical boundary and could be

coordinated on a regional basis. Establishment of a network of regional coalitions could improve communication among local governments and increase the effectiveness of waste reduction strategies.

### **2.1.3.3.5.3. Increase Education**

Although ongoing education is a current requirement of recycling responsible unit certification, it is the smallest expenditure of most local government recycling programs. Similarly, while landfill operators in Wisconsin are required to have continuing education, no such requirement applies to recycling managers, material recovery facility operators, compost site managers, and other similar positions. The following steps could improve educational efforts.

- ✓ *Establish a certification program for solid waste managers and operators.*

A certification and ongoing training program could be developed for solid waste managers and operators. At a minimum, this program would include landfill, recycling, household hazardous waste and composting facility operators and managers. In addition, an ongoing training requirement could be included as part of the Responsible Unit certification for local recycling programs. This training program could focus not only on environmental compliance issues, but operational and cost savings strategies as well. The program could be developed by UW-Extension and DNR, with ongoing management by a suitable private organization.

- ✓ *Expand public outreach and communication.*

Educational outreach has generally been focused upon informing the public of new requirements regarding state law and, as state funding has been reduced, has rarely been sustained at the community level. An ongoing public information and outreach effort could be conducted at the state level to provide educational tools and resources, as well as mass media attention to encourage integrated solid waste management.

- ✓ *Broaden business community technical assistance and outreach.*

Many sectors of the business community would benefit from reduced solid waste management costs as a result of improved education and technical assistance. A targeted campaign, utilizing business expertise and resources, could be developed to encourage pollution prevention and waste reduction. Since little data exists on commercial waste generation, this targeted campaign could encourage waste cost accounting and develop a methodology for assessing improvements in efficiency that have resulted from adoption of integrated waste management strategies by businesses.

- ✓ *Expand technical assistance initiatives among high volume waste generators.*

Over half of all Wisconsin's solid waste is high volume industrial waste. Coal ash and foundry sand use is relatively high (over 42% in 1998) and continues to increase

gradually. However, there are also opportunities for industrial waste reduction that are not being implemented. Despite outreach efforts, progress on reducing the amount of waste going to landfills has been lower than expected. Technical assistance and other sector based educational efforts could be greatly expanded to encourage industry-sponsored solutions to reduce waste.

#### **2.1.4.3.5.4. Manage Solid Waste and Recycling Together**

- ✓ *Assign responsibility for coordinating solid waste management to the counties.*

Counties are increasingly becoming involved with solid waste management, often in response to landfill expansions within their borders. However, many counties have not shared in the responsibility of implementing an integrated solid waste management program, unless specifically asked by their own municipalities. As in the states of Iowa and Minnesota, Wisconsin could assign overall responsibility for solid waste management to the counties, including planning, monitoring, and enforcement functions.

- ✓ *Require coordinated service delivery at the local level.*

Since most of Wisconsin's solid waste collection system is privatized, significant improvements in efficiency and effectiveness can be achieved by coordinating service delivery. Local governments could be required to maximize operating efficiency by facilitating collection services based upon geographic area rather than type of waste collected. Savings in operational costs should result from minimizing the number of vehicles operating within a region or area.

- ✓ *Encourage the development of integrated waste management processing facilities.*

Wisconsin currently has 128 compost facilities, 142 recycling material recovery facilities, 2 waste-to-energy plants, and 93 landfills. Increasingly, landfill operators have expanded to include yard waste composting and household hazardous waste collection operations. This trend could be encouraged in order to create one-stop processing operations and integrated solid waste management. Similarly, existing material recovery facilities could be evaluated to determine possible efficiency improvements that could result through co-locating with other solid waste operations.

#### **2.1.5.3.5.5. Review Landfill Bans on Materials**

- ✓ *Evaluate the life cycle cost of specific materials and determine the best disposal option.*

Developing a plastics recycling infrastructure has had limited success in Wisconsin. A life cycle analysis of these materials and others indicates that recycling some of this material may not be the most economically and environmentally sound option. A life cycle analysis of the environmental and economic cost and benefits of various materials could be used to determine which solid waste management option is most appropriate.

In addition, differences in population density between rural and urbanized areas could be assessed to allow for greater flexibility in the required recycling of these materials.

✓ *Encourage producer responsibility for special materials.*

The battery industry has been extremely effective at reducing the toxicity of batteries, as well as developing best management practices in a collaborative fashion. A similar initiative by the thermostat industry has resulted in an industry sponsored collection and management program. Other special materials, such as oil filters, mercury-containing thermometers and computers, could be targeted for elimination from landfilling. UW-Extension and the DNR could initiate industry sponsored forums to eliminate toxic raw materials, where possible, and facilitate the development of producer managed programs for materials that cannot be eliminated. In addition, all materials that are disposed of in landfills could be evaluated on an on-going basis to determine opportunities for industry led waste reduction and recovery programs.

✓ *Investigate and test new landfill technologies.*

Encourage pilot projects to test new landfill operation and design, and to test other treatment and disposal options, with the potential to reduce long term environmental risks and increase recovery of materials and energy. Examples of such projects include bioreactor landfills, and in-vessel solid waste processing through composting and high solids anaerobic digestion.

#### **4. Next Steps for DNR and UW-Extension**

To address these findings and trends, the DNR and UW-Extension have agreed to focus on options that can be implemented under current state statutes. These include:

1. Initiate a consensus-building process to develop common expectations and goals/objectives for improved waste management in Wisconsin, using the Environmental Management System (EMS) model with extensive stakeholder involvement. The EMS framework and environmental goals/objectives are expected to guide a shift in our thinking from management of wastes to sustainable management of materials. This effort could eventually result in statutory changes and may have an impact on the suggestions listed below.
2. Develop a policy framework to reduce pollution from persistent, bioaccumulative toxics (PBTs); revise and update solid and hazardous waste regulations as needed to be consistent with the new framework.
3. Wherever cost savings and increased efficiency can be gained, encourage counties and local governments to coordinate delivery of recycling, waste disposal, household hazardous waste collection and programs for other materials (such as tires and electronics). This will entail using current resources as well as supporting the development of new incentives.

4. Building on the major recycling education and outreach efforts that began in 1990, identify new messages and methods to sustain the success we have had with changing behaviors regarding recycling and waste reduction. Continue information and outreach activities targeted toward recycling program managers, haulers, waste facility operators, businesses and the public on waste reduction, recycling and waste disposal. Develop initiatives to reach newly identified audiences and sectors. DNR and the UW-Extension should continue to offer and provide assistance to local government managers to analyze program costs and identify opportunities to improve cost effectiveness.
5. Support and encourage the efforts of manufacturers, retailers and generators to create systems for recycling additional materials, especially computers, electronics, textiles, food waste, carpeting, paint, batteries, construction and demolition debris, pallets and wood waste. Both agencies should actively encourage voluntary actions by manufacturers to reduce the quantity and toxicity of their wastes and to take responsibility for the recovery of their products for recycling or reuse.
6. Review specific recyclable materials using life cycle analysis tools to calculate environmental costs and benefits. Work with industry, business and local governments to develop an infrastructure to recycle appropriate materials. If other alternatives fail to reduce landfill disposal, give careful consideration to additional landfill disposal bans for materials that may prove to have significant environmental benefit to recycle. Also, consider dropping landfill disposal bans for materials that have least benefit to recycle.
7. With stakeholders, carefully examine the efficacy of limiting the size of municipal waste landfills to ensure that technology such as leachate collection piping can be easily maintained over the decades of operation and post-closure. Landfill components (leachate collection and removal systems, and liners) should not be buried so deeply as to be unreachable for repair, and gas should be able to be effectively removed from the entire landfill depth.
8. Evaluate, with stakeholder involvement, and adopt regulations to allow development of new landfill technologies that could minimize long-term risks to the environment. In particular, seek flexibility from EPA to allow leachate recirculation at some municipal waste landfills to fully investigate the “bioreactor” concept. Also examine the alternative of eliminating organics from the landfill or treating organics before landfilling.

## **5. Recommendations for Legislative Consideration**

In addition to the initiatives outlined above, the Department of Natural Resources and the UW-Extension suggest that the Wisconsin Legislature consider the following ideas to address the issues identified in this report:

1. Develop a set of financial mechanisms (tax rebates for recycling of industrial materials, credits for technologies that reduce or eliminate waste generation, and solid waste disposal fees) designed to encourage waste reduction and recycling, and discourage waste disposal. Such mechanisms would enhance the management of waste according to the current waste management hierarchy, improve the cost-competitiveness of recycling and stimulate the use of more efficient production technology.
2. Develop new incentives to encourage communities to examine coordination of solid waste management activities wherever cost savings and increased efficiency can be gained.
3. Volume considerations, toxicity, and/or the ability to reuse or recycle are especially important for certain materials presently in the waste stream. These include computers, electronics, textiles, carpeting, paint, batteries, food waste, construction and demolition debris and products containing mercury or other persistent bioaccumulative toxics (PBTs). Consider appointing a Task Force or Legislative Council study committee, or directing the Department to further evaluate product stewardship initiatives for these special materials, and establish policy, as appropriate.
4. In view of the mounting scientific evidence indicating that the use of burn barrels is a significant source for human exposure to persistent bioaccumulative toxics (PBTs) and the release of PBTs to the environment, appoint a Task Force or direct Department of Natural Resources to examine and recommend further action on the use of burn barrels.
5. Direct an evaluation for an increase to the 40-year post-closure financial responsibility period for new municipal waste landfills and lateral expansions to more closely reflect the period of care actually expected to be necessary.

## **6. Conclusion**

Wisconsin has been recognized nationally as a leader in solid waste management and recycling. These programs have served as models for other states, as well as for national programs. The breadth of the solid waste management program in Wisconsin is significant, covering such wastes and management practices as recycling, hazardous waste from households and businesses, tires, medical wastes, industrial by-products, littering, land application and landfills.

As a result of these programs, approximately 1 million tons of industrial waste was reused or recycled in 1999; landfill design is more protective of the environment than 10 years ago; solid waste is managed to prevent nuisance conditions and to protect the environment; the diversity of services provided in Wisconsin is good; and municipal solid waste is recycled or reused so that 40% is diverted from landfills. The per capita solid waste generation in Wisconsin is 3.97 pounds/person/day (1995) as opposed to

4.41 pounds/person/day, nationally (1995). People and businesses in Wisconsin are committed to reducing the amount of waste they generate.

Improvements to the solid waste management systems in Wisconsin should continue so that this state remains a national leader. While a number of suggestions have been included in this report, one should be completed early so that other improvements can be completed in a holistic way, involving the many stakeholders interested in waste management. Using the environmental management system tool (ISO 14001), with extensive stakeholder involvement, common expectations and goals and objectives for waste management in Wisconsin will be developed. This will help clarify the goals and strategies the DNR, UW Extension and other stakeholders use to manage waste in Wisconsin and provide for any changes needed to improve or shift the programs.

The Department has already begun using the EMS in policy for the waste management program, involving UW Extension and other stakeholders in how best to approach establishing common goals and objectives including a broad array of interests. More information on what other states are doing in the area of waste management will be collected as part of this effort. The goal of this effort is to improve the use of public resources in managing wastes in Wisconsin, and to eventually shift thinking from management of wastes to sustainable management of materials. In the interim we will continue to pursue the initiatives outlined above to continue to provide the quality of service the residents of Wisconsin expect.